

U.S. Patent Application Serial No. 10/019,287
Response filed March 4, 2005
Reply to OA dated October 7, 2004

REMARKS

Claims 1-88 are pending, with claims 1-5, 12-18 and 31-33 currently withdrawn from consideration. Claims 6, 11, 19, 30, 34, 43, 44, 55, 63, 64, 75, 76, 85, 86, and 87 have been amended herein.

Claims 6-11, 19-30, and 34-88 are rejected under 35 U.S.C. §112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. (Office action page 3)

The rejection is overcome by the amendments to claims 6, 11, 19, 30, 34, 43, 44, 55, 63, 64, 75, 76, 85, 86, and 87.

The Examiner refers to the phrase "1 to 4 kinds of adsorbents," indicating that the word "kinds" is indefinite. In the amendments to the claims, the phrase "kinds of" is deleted.

Applicant submits that no new matter is added by this amendment. The meaning of the original wording, "kinds of adsorbents," can be understood from the disclosure on page 120, line 23, to page 121, line 25. Here, examples of "combinations of adsorbents" or "at least three adsorbents"(page 121, line 17), etc., are given. The different "kinds of adsorbents" refer to different chemical species used as adsorbents. The amendment to claim 6 therefore results in the wording "treatment with 1 to 4 adsorbents," with corresponding wording in the other amended claims, and this wording is supported by page 121 of the specification.

In addition to the above amendments, an excess comma is deleted in claim 19.

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Claims 6-11, 19-30, and 34-88 are rejected under 35 U.S.C. §103(a) as being unpatentable over Fukuda et al (U.S. 5,185,092) in view of Satoru et al (JP-07-233385) and Hiroyasu (JP-10-140170). (Office action page 4)

The rejection of claims 6-11, 19-30, and 34-88 is respectfully traversed, and reconsideration of the rejection is requested.

Regarding claims 6-11:

a) Regarding Fukuda et al. The Examiner cites Fukuda et al., in column 2, lines 16-27, column 3, lines 12-14, and column 6, lines 35-65, as disclosing most of the claimed process. Applicant notes the following differences between the teachings of Fukuda and claim 6 of the present invention.

First of all, claim 6 specifically recites a process for making a diester of an **alicyclic** dicarboxylic acid, which is cyclohexanedicarboxylic acid, methylcyclohexanedicarboxylic acid, cyclohexenedicarboxylic acid or methylcyclohexenedicarboxylic acid, starting with the corresponding diacid.

Fukuda generally discloses “a base oil [that] is a diester of an aliphatic monohydric alcohol and an aliphatic dicarboxylic acid” or an aromatic dicarboxylic acid (column 2, lines 21-26). Other base oils are also possible (column 2, lines 27-34). Of this general disclosure, only the disclosure of an aliphatic dicarboxylic acid ester would be relevant to claim 6, and this would only be applicable to cyclohexanedicarboxylic acid or methylcyclohexanedicarboxylic acid, which are aliphatic.

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The aliphatic dicarboxylic acid is described in more detail in Fukuda in column 5, lines 5-12, in which 12 specific examples are given, **none of which** is a cyclohexanedicarboxylic acid. This list is also repeated in column 5, lines 38-48. Therefore, Fukuda **does not disclose the limitation** of the four specific **alicyclic** dicarboxylic acids in claim 6; the disclosure of aliphatic dicarboxylic acids in Fukuda is essentially **infinite**, and the preferred dicarboxylic acids are not those of claim 6. Fukuda therefore does not **suggest** the structural limitations on the alicyclic dicarboxylic acid of claim 6.

Secondly, Fukuda is different from claim 6 of the present invention in that Fukuda does not disclose the importance of setting the starting monohydric alcohol peroxide value to be below 1.0 meq/kg, as specified in claim 6. As described in the Examples of the present specification, the peroxide value of the starting monohydric alcohol greatly influences the peroxide value of the diester obtained. Applicant has attached Reference Table 1 to this Amendment, summarizing relevant Examples 1-1 to 1-3 and Comparative Examples 1-1 and 1-4.

Thirdly, Fukuda discloses in column 6, line 7, esterification "in the presence of an acid catalyst, e.g., phosphoric acid." That is, an acid catalyst is required and the only one suggested is phosphoric acid, inconsistent with the process of claim 6, in which either no catalyst or a sulfur-free and phosphorus-free catalyst is used (step (i)). Fukuda therefore does not disclose or suggest the catalyst limitation of claim 6. Applicant also notes that the Examiner states that the prior art is "silent" with regard to the 20 ppm or less phosphorus content limitation recited in claim 6. However,

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Fukuda's use of a phosphoric acid catalyst would tend to increase the phosphorus content of the product. Fukuda's use of phosphoric acid therefore suggests away from the 20 ppm or less limitation.

Fukuda further differs from claim 6 in not disclosing a step of removing excess starting materials, are recited in claim 6 (step (ii)).

In addition, Fukuda nowhere discloses the importance of neutralization nor washing with water, thereby differing from claim 6 (step (iv)). A neutralization step is necessary to remove unreacted carboxylic acid(s), and decompose any catalyst used in the reaction and organometallic compounds derived from the catalyst (present specification, page 117, lines 10 to 13). A washing with water step is required in order to reduce the total acid value of the esterification reaction product (present specification, page 117, line 22 to page 118, line 8).

In addition, Fukuda does not disclose a dehydrating step as required in claim 6 (step (v)).

(b) Regarding Satoru et al. The Examiner points out that Satoru discloses the preparation of polyvalent carboxylic acid esters from an alicyclic polyvalent carboxylic acid (e.g. 1,4-cyclohexanecarboxylic acid) with a monohydric alcohol and that it also discloses a neutralization step.

However, Satoru nowhere discloses the peroxide value of the starting monohydric alcohol, which is specified in claim 6 (step (i)).

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Satoru discloses phosphoric acid used as a catalyst (paragraph [0037]), while phosphorus-free catalyst is employed in claim 6 (step (i)).

The process of Satoru lacks a step of removing excess starting materials, which is recited in claim 6 (step (ii)).

Further, Satoru does not teach a step of neutralizing the polyvalent carboxylic acid ester or washing the neutralized ester with water, which is recited in claim 6 (step (iii)). More specifically, paragraph [0013] of Satoru et al. discloses, as usable esters: "... **polyol esters, multiple-valued carboxylate, fumaric-acid ester oligomer, carbonates, hydronalium KISHIBI valine acid ester [hydroxypivalates]**, and those combination...."

However, it is disclosed later in paragraph [0039] of Satoru et al. that (improving on the machine translation), **when purifying polyol esters, fumarate oligomers, carbonates and hydroxypivalates**, a purification process that does not influence the electrical insulating properties of the final product is preferably employed. Especially, since it is difficult to remove sodium components in a purification step, by employing a purification process not using a compound containing the element sodium, esters with excellent electrical insulating properties can be obtained through only a few purification steps. As a purification process that does not involve the element sodium, a process using potassium hydroxide or calcium hydroxide, etc., in the **neutralization** of the free fatty acid after the esterification is usefully employed. To enhance the refrigerant stability,

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it is preferable that the esters have a peroxide number of less than 1 meq./kg, an aldehyde number of less than 1 mg KOH /g, and a bromine number of less than 10 mg /100g.

Applicant notes that the neutralization of "polyvalent carboxylates" is absent in paragraph [0039] of the reference.

Example 1 (paragraphs [0055] to [0056]) of Satoru discloses esterification using $\text{Ti}(\text{OBu})_4$ as a catalyst, neutralization with potassium hydroxide and washing with distilled water; however, such a process is applied to an esterification process of "pentaerythritol" with "2-ethylhexanoic acid", but not to the preparation of "polyvalent carboxylate." Applicant submits that Satoru does not disclose a neutralization step of "polyvalent carboxylates", nor does the reference teach a washing with water step of polyvalent carboxylates, which is specifically recited in claim 6, and serves to reduce the total acid number.

Nor does Satoru disclose the ester dehydration step recited in Claim 6 (step(v)).

(c) Regarding Hiroyasu. Hiroyasu discloses that an aromatic tribasic acid anhydride (trimellitic acid anhydride) and a monohydric alcohol can be esterified in the absence of a catalyst; however, replacement of Fukuda's aliphatic dicarboxylic acid with Hiroyasu's aromatic tribasic acid does not lead to the invention of claim 6, since this produces a triester, not a diester.

Applicant submits that, given the lack of teaching or suggestion in the cited references for the claim limitations as discussed above, Fukuda et al., Satoru et al., and Hiroyasu cannot be combined to produce the invention of claim 6, or of dependent claims 7-11.

Regarding Claims 19-30 and 34-88

(a) Regarding Fukuda et al.

Claims 19, 34, 44, 64, 76 and 86 require an alicyclic or aromatic dicarboxylic acid as starting material. Applicant has argued above with regard to claim 6 that Fukuda et al. does not suggest the limitations on the alicyclic dicarboxylic acid. Therefore, only Fukuda's teachings on aromatic dicarboxylic acid esters are relevant to these claims.

More significantly, claims 19, 34, 44, 64, 76 and 86 specifically require a **mixed** dicarboxylic acid diester. Although the two ester groups may be different in Fukuda, in all of the listed examples the two ester groups are the same (column 5, lines 64 to 66). In contrast, in the processes of claims 19 and 34 of the present application, " R^5 and R^6 are different from each other", that is, a mixed diester is required (a similar requirement exists in claims 44, 64, 76 and 86). Fukuda does not disclose this specific limitation of these claims.

In particular, the **mixed** diester is achieved in claims 19 and 34 through a stepwise esterification process (steps (i)(a) and (i)(b) in these claims, with related recitation in claims 44, 64, 76 and 86). Fukuda clearly does not disclose this specific esterification process.

Moreover, as discussed above for claim 6, Fukuda discloses use of phosphoric acid as an esterification catalyst, inconsistent with the invention of the present claims, in which either no catalyst or else a sulfur-free and phosphorus-free catalyst is used (for example, claim 19, step (i)). As discussed above for claim 6, it is clear that using a phosphorus-containing catalyst in an esterification step will increase the content of phosphorus of the diester obtained, and Fukuda clearly does not suggest the 20 ppm or less phosphorus content limitation of the present claims.

In addition, as discussed above for claim 6, Fukuda differs from the present claims (for example, claim 19 (step (ii))) in not disclosing a step of removing excess starting materials. Also, as discussed above for claim 6, Fukuda nowhere discloses a neutralization step nor washing with water step, as in (step (iv)) of claim 19. The neutralization step serves to remove unreacted carboxylic acid(s), and decompose any catalyst used in the reaction and organometallic compounds derived from the catalyst (present specification, page 117, lines 10 to 13). A washing with water step serves to reduce the total acid number of the esterification reaction product (present specification, page 117, line 22 to page 118, line 8). Fukuda does not disclose a dehydrating step as recited in claim 19 (step (v)).

(b) Regarding Satoru et al. The Examiner points out that Satoru discloses the preparation of polyvalent carboxylic acid esters from an alicyclic polyvalent carboxylic acid (e.g. 1,4-cyclohexanecarboxylic acid) with a monohydric alcohol and that Satoru also teaches a neutralization step.

However, the present claims require a specific two-step esterification process (for example, claim 19, steps (i)(a) and (i)(b)). Satoru does not appear to disclose such a process.

Moreover, phosphoric acid is used as a catalyst (paragraph [0037]) in Satoru, while phosphorus-free catalyst is employed in the second esterification step of the present claims (claim 19, step (i)(b)). Furthermore, Satoru's method lacks the step of removing excess starting materials, as recited in claim 19 (step (ii)).

Further, Satoru does not teach neutralizing of alicyclic polyvalent carboxylic acid ester or washing of the neutralized ester with water, as recited in claim 19 (step (iii)).

Neither does Satoru disclose a dehydration step of the esters, as recited in claim 19 (step (v)).

(c) Regarding Hiroyasu. Hiroyasu describes that an aromatic tribased acid anhydride (trimellitic acid anhydride) and a monohydric alcohol can be esterified in the absence of a catalyst. However, substitution of Fukuda's aliphatic dicarboxylic acid with Hiroyasu's aromatic tribasic acid would not lead to the invention of the present claims, since this would produce a triester, not a diester.

Moreover, the present claims specifically recite a **mixed** diester and a two-step esterification process for producing the mixed diester. Hiroyasu does not appear to specifically disclose a mixed ester or such a process.

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Furthermore, Hiroyasu does not disclose removing excess starting materials (claim 19, step (ii)), neutralizing and washing the mixed ester (step (iii)) or dehydrating the mixed ester (step (v)).

Given the lack of teaching or suggestion in the cited references for the above noted limitations, Applicant submits that no combination of Fukuda, Satoru and Hiroyasu can produce the invention of claims 19-30 and 34-88.

In view of the aforementioned amendments and accompanying remarks, the claims, as amended, are in condition for allowance, which action, at an early date, is requested.

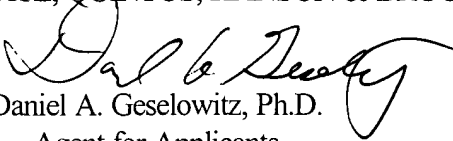
If, for any reason, it is felt that this application is not now in condition for allowance, the Examiner is requested to contact Applicant's undersigned agent at the telephone number indicated below to arrange for an interview to expedite the disposition of this case.

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In the event that this paper is not timely filed, Applicant respectfully petitions for an appropriate extension of time. Please charge any fees for such an extension of time and any other fees which may be due with respect to this paper, to Deposit Account No. 01-2340.

Respectfully submitted,

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Attachment: Reference Table 1

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